A Decoupled Hydrogen Boost Electropump for Nuclear Thermal Propulsion, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

NASA has identified Nuclear Thermal Propulsion (NTP) as an advanced propulsion concept for human missions to Mars. It is seeking technologies related to NTP for development of the reactors and technologies needed for ground testing. In the area of ground testing, NASA is interested in approaches to efficiently generate high temperature, high flow rate hydrogen. TGV Rockets, Inc., proposes development of a modular pump based on TGV's ElectroCycle motor technology to augment a NTP propellant management system. The pump is based on TGV's ElectroCycle motor technology utilizes cryogenic cooling to boost power density to levels on the order of 11 hp/lb, making it competitive with conventional gas turbine technologies. The electopump approach offers the advantage of predictable flow control, real time engine health management, and tailored mixture ratio control for improved performance. Specific applications include boosting main turbopump performance, smoothing start-up transients, improving shutdown cooling, and distributed flow management . The specific research will size a motor and pump to address NTP start-up transients, evaluate design trades, determine power and thermal requirements, and further investigate opportunities to apply the electropump for performance improvement and reduction of safety risks.

Anticipated Benefits

Deep Space Human Exploration,

1,000 AU explorer,

Pluto Orbiter,

Solar Polar.

Large Moon human transport,

Fast Mars transfer vehicle

DoD high Energy Upper Stage.

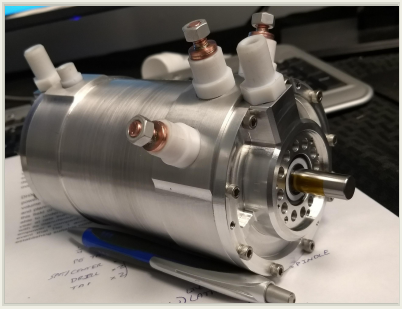

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Table of Contents

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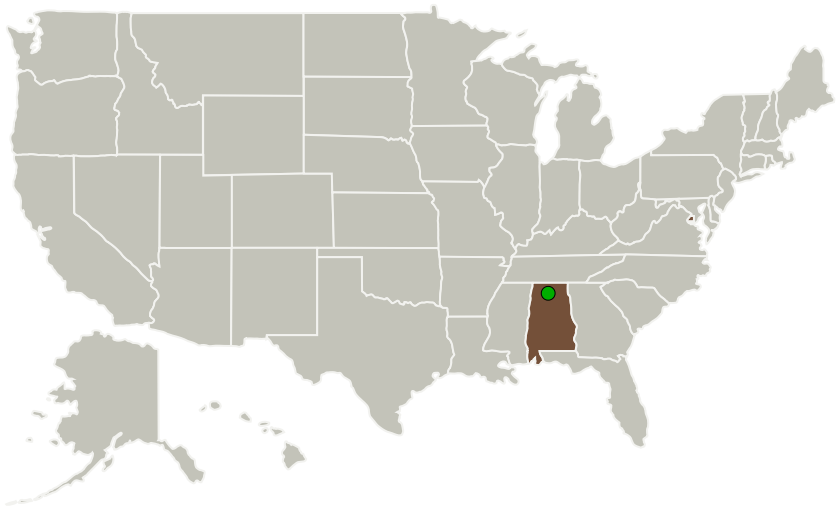
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
TGV Rockets, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Washington, District of Columbia
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	District of Columbia

Project Transitions

July 2018: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

TGV Rockets, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

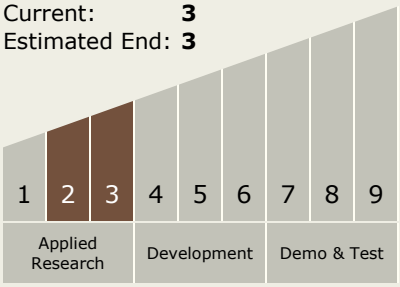
Carlos Torrez

Principal Investigator:

Derek Lang

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140883)*

Images

Final Summary Chart Image
A Decoupled Hydrogen Boost Electropump for Nuclear Thermal Propulsion, Phase I
(https://techport.nasa.gov/image/134608)

Project Image
A Decoupled Hydrogen Boost Electropump for Nuclear Thermal Propulsion, Phase I
(https://techport.nasa.gov/image/128012)

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.4 Advanced Propulsion
    - TX01.4.3 Nuclear Thermal Propulsion

Target Destinations

Mars, Earth